

CLAIMS

1. A vertical heat treatment system comprising:
 - a heat treatment furnace having a furnace throat in a lower part thereof;
 - a lid that hermetically closes the furnace throat;
 - a holder, disposed on the lid, that holds a plurality of process objects at vertical intervals via ring-shaped support plates;
 - an elevating mechanism that moves the lid vertically to load and unload the holder into and from the heat treatment furnace; and
 - a transfer mechanism, including a plurality of substrate support devices spaced at intervals, that transfers process objects between the holder and a container holding therein a plurality of process objects at intervals,
- wherein:
 - the transfer mechanism has gripping mechanisms each configured to grip a process object on an under side of respective one of the substrate support devices, and each of the gripping mechanisms has a fixed engagement member fixedly provided on a distal end of respective one of the substrate support devices to be engaged with a front edge portion of a process object and a movable engagement member movably attached to a proximal end of respective one of the substrate support devices to be disengageably engaged with a rear edge portion the process object.
2. The vertical heat treatment system according to claim 1, wherein each of the substrate support devices is provided with seats that receive front and rear peripheral portions, respectively, such that a gap is formed between a lower surface of the substrate supporting device and an upper surface of the process object.
3. The vertical heat treatment system according to claim 1,

wherein each of the ring-shaped support plates has cutouts for preventing the ring-shaped support plate from colliding with the fixed engagement member and the movable engagement member.

4. The vertical heat treatment system according to claim 1, wherein at least one of the substrate support device is provided with a mapping sensor, which is configured to detect a position of a detection object by moving the substrate support device such that a light beam traveling between two distal ends of the substrate support device is interrupted by the detection object.

5. The vertical heat treatment system according to claim 1, wherein the fixed engagement member and the movable engagement member are formed of a heat-resistant resin.

6. A method of transferring process objects in a vertical heat treatment system including: a heat treatment furnace having a furnace throat in a lower part thereof; a lid that hermetically closes the furnace throat; a holder, provided on the lid, that holds a plurality of process objects at vertical intervals via ring-shaped support plates; an elevating mechanism that moves the lid vertically to load and unload the holder into and from the heat treatment furnace; and a transfer mechanism that transfers process objects between the holder and a container holding therein a plurality of process objects at intervals,

wherein said method employs, as the transfer mechanism, a transfer mechanism including a plurality of substrate support devices spaced at intervals, and having gripping mechanisms each configured to grip a process object on an under side of respective one of the substrate support devices, and each of the gripping mechanisms has a fixed engagement member fixedly provided on a distal end of respective one of the substrate support devices to be engaged with a front edge portion of a process object and a movable engagement member movably

attached to a proximal end of respective one of the substrate support devices to be disengageably engaged with a rear edge portion the process object, and

wherein said method includes the steps of: placing each of the substrate support devices above respective one of the process objects positioned in their transfer start position; moving the movable engagement members toward the fixed engagement members to grip the process objects; moving the substrate support devices each gripping the process object to a position above their transfer target position; and moving the movable engagement members away from the fixed engagement members to release the process objects whereby the process objects are mounted on their transfer target position.